

MEARNS' QUAIL MANAGEMENT GUIDELINES

Procedure 1: To collect annual data on age, sex, and hunt success of harvested quail.

- A. Wing barrels may be set up in areas of Mearns' quail hunter concentrations. Wing barrels will be set up at least 2 days before the opening of the season and checked immediately following the opening weekend. The barrels will be checked weekly for the first month of the season and once every other week for the remainder of the season. Each time the barrels are checked, all used wing envelopes will be collected and labeled by location and the supply of envelopes replenished. The information from envelopes will be recorded. Wing barrels are to be fitted with locks to prevent data tampering and to encourage hunters to provide accurate harvest location data.
- B. The operation of the wing barrels is the responsibility of the Regional Game Specialist. The Game Specialist and Small Game Biologist will summarize the data annually. A summary of results will be submitted to Game Branch within 6 weeks after the last day of the quail season.

Procedure 2: To use survey and harvest data to support quail hunt regulations, to gain insight into quail population dynamics, and to inform the public of recreational opportunity.

- A. Questions regarding Mearns' quail harvest will be included in the standard small game hunt questionnaire. Hunt questionnaires will be sent to a random sample of general hunting license holders by February 1. The collection and distribution of questionnaire data and results will be the responsibility of the Game Branch. Data will be tabulated, summarized, and sent to the Game Specialists within 60 days of the initial mailing. Hunt questionnaires are valuable because they provide an unbiased long-term dataset on hunter effort and behavior.
- B. Because Mearns' quail hunters are a small proportion of the hunter pool, relatively few hunters are surveyed with the small game hunt questionnaire. Game Branch will periodically send an additional questionnaire to known Mearns' quail hunters. Names for this list will be collected from wing barrels, field interviews, and other sources. Game Branch will be responsible for updating and maintaining this list.
- C. Game Branch will continue to pursue additional methods to identify and survey Mearns' quail hunters.

Procedure 3: Protect and enhance Mearns' quail habitat through coordination with land management agencies and private landowners.

- A. Review allotment management plans to assure that grazing management is consistent with the needs of quail.

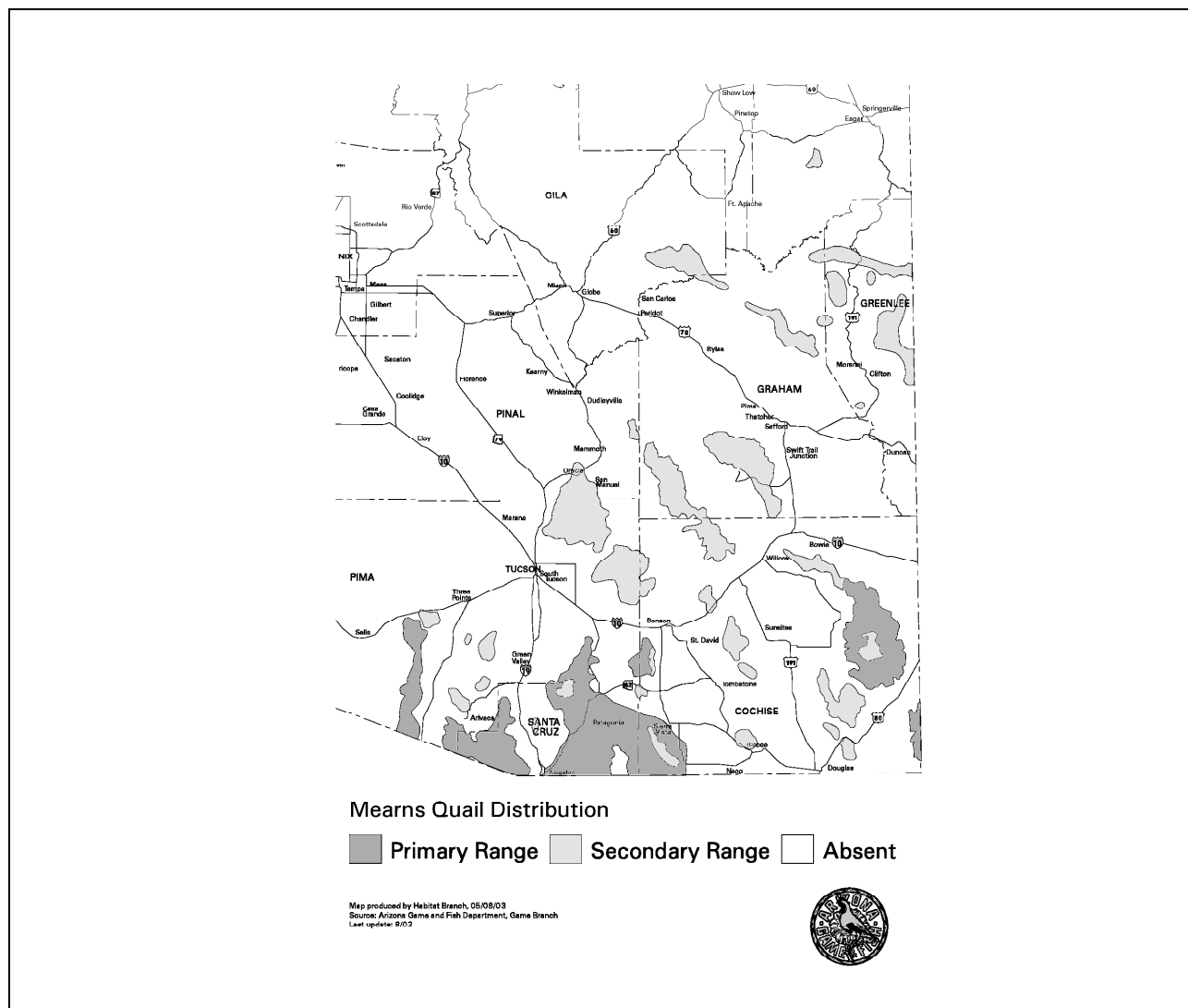
- B. Evaluate and critique plans for activities on public lands that may affect Mearns' quail habitat. Examples of such activities include fuelwood cutting, intensive public recreation, prescribed burns, brush treatments, and road-trail construction. Advise agencies when such activities are potentially detrimental to Mearns' quail (Appendix A).

Appendix A. MEARNS' QUAIL HABITAT MANAGEMENT GUIDELINES

INTRODUCTION

Mearns' quail (*Cyrtonyx montezumae mearnsi*) occur in limited distribution in Arizona. Their primary range is within southeastern Arizona mountain ranges (Figure 1). Secondary range, where they are found less frequently or where they were documented by early explorers in Arizona, is more widespread, including isolated areas above the Mogollon Rim. The main vegetation associations supporting Mearns' quail populations are Madrean evergreen woodlands and oak-pine forests with abundant grass cover. The Coronado National Forest (U.S. Forest Service) is responsible for the management of most of the suitable Mearns' quail habitat in Arizona.

Figure 1. Distribution of Mearns' quail in Arizona.



Mearns' quail are a popular game species in Arizona. There has been considerable discussion among hunters, wildlife managers, and land managers of the impact of hunter harvest on quail populations. The Arizona Game and Fish Department has conducted several studies addressing the impact of harvest on Mearns' quail populations (e.g., Brown 1979, Bristow and Ockenfels 2000) and continually analyzes harvest data to assess the effect of harvest on quail populations. There is no evidence that hunting harvest is depressing or has depressed populations. While hunter harvest can temporarily reduce Mearns' Quail numbers in easily accessible locations (e.g., Gardner and Hog Canyons), research and management experience shows weather patterns and habitat conditions are responsible for annual fluctuations in overall Mearns' quail abundance.

GENERAL BIOLOGY

Like most gallinaceous birds, Mearns' quail populations are highly dynamic and large variation in abundance from year to year is common. Annual precipitation has a significant influence on abundance, particularly summer precipitation (Brown 1989). The population, in both hunted and unhunted areas, is highest shortly after the young-of-the-year hatch and declines over time to its lowest just before the next hatch. Most Mearns' quail probably die in the first year of hatching (Stromberg 1990). No data is available on longevity of birds in the wild, but based on studies conducted on other quail species, few individuals are likely to reach four years of age. Birds in captivity have been reported to reach 6–7 years of age (Stromberg 2000).

Reproduction

Mearns' quail pairing typically occurs from late February to March and nesting usually occurs from mid June to mid August (Wallmo 1954, Bishop 1964). Nests are made on the ground either on slopes or adjacent to ground structure such as a tree or boulders. Most often nests are covered chambers with a woven canopy of perennial bunchgrass. First broods appear in mid June to September (Bishop 1964), with the peak hatch occurring in August. Timing of pairing, nest building, and hatch is somewhat variable and dependent on summer rainfall patterns. Covey size varies throughout the year with pairs of birds most common in late winter. After the hatch, coveys are generally family groups of 6–15 birds. Young birds typically remain with adults for about 6 months after hatching, then disperse and form new coveys. The number of birds per covey declines from post-hatch to pre-hatch due to mortality and dispersion.

Movement

Home range for coveys is relatively small in size. Quality and quantity of habitat components influences home range size. Stromberg (1990) found that radio-marked birds seldom moved more than 200 feet in a day and coveys typically range over small areas (<15 acres; Brown 1978), although larger movements have been documented.

Brood success in Mearns' quail is less variable than for other southwestern quail species such as scaled quail and Gambel's quail (Brown 1978, Heffelfinger and Olding 1997). Wings from hunter-harvested birds have been consistently collected in Arizona since 1984. Mean percent juveniles in the harvest from 1984 to 2003 was 73% (range 48–83%). With fairly consistent reproduction, Mearns' quail population size in summer is more dependent on winter survival and population carry over than for desert quail species (Brown 1989). Maximum populations are achieved when high summer rainfall follows years of high population carry over (Brown 1979).

This results in increased populations because juveniles that survive their first winter are able to breed the following summer during a period of favorable habitat conditions.

HABITAT REQUIREMENTS



Mearns' quail rely heavily on oak-grassland or pine-grassland savannas. They rarely occur in other habitat associations, except during years of peak abundance. However, Mearns' quail do not occur in areas without an adequate grassland component (Brown 1989). Mearns' quail are occasionally associated with other "overstory" species including catclaw (*Acacia greggii*, Brown 1989), mesquite (*Prosopis* spp., Bishop 1964), and palo verde (*Cercidium* spp., Stromberg 2000). Nearly all studies of Mearns' quail habitat requirements have found areas with high grass diversity and grass cover height associated with a tree overstory of oak (*Quercus* spp.) or pine (*Pinus* spp.), are best for this species. Perennial bunchgrass species are most often used for cover and nesting. These grasses are warm season species produced during periods of monsoon moisture (July–September). Mearns' quail depend on hiding cover for defense from predators, nest construction, and thermal protection in all stages of their life cycle (Wallmo 1954; Bishop 1964; Brown 1978, 1982, 1989; Stromberg 2000). Grass cover requirements for Mearns' quail remain consistent from year to year, while environmental conditions and grazing intensity varies. Percent use, a typical measure of livestock grazing pressure, is not a good gauge of habitat condition since in years of poor grass production, even light use by cattle may reduce grass height below the level needed by Mearns' quail. Intuitively, the cover requirements for this species does not decline during dry years. Direct measure of grass height, percent cover, and species diversity would be the most effective means of assessing the grassland component of Mearns' quail habitats.

Grassland Component

Mearns' quail are approximately 4 inches (6 inches when standing erect) in height and select for areas with higher horizontal cover in all heights from 2–20 inches over those provided at random locations (Bristow and Ockenfels 2000, 2004). Mearns' quail rely on their cryptic coloration and "freezing" as their primary defense from predators (Brown 1989), the effectiveness of which is

influenced by grass canopy and grass height. One study suggests predation from aerial predators can be significant (Stromberg 1990), which could account for selection of taller, more dense grass cover (Bristow and Ockenfels 2004).

Spatial arrangement of both grassland and woodland cover types is very important for this species due to its survival strategy, small home range, dispersal distances, and food habits. Adequate grass horizontal and vertical cover must be well distributed across the landscape to meet the cover needs of this species. The percentage and distribution of suitable habitat patches will determine the amount of use a given pasture receives (Brown 1982), and connectivity between suitable patches is essential for dispersal.

Within grassland habitats, a portion should be managed to provide maximum cover from predators, particularly from aerial predators (e.g., Cooper's hawks; Stromberg 1990). Escape cover needs are best met by providing large areas that contain grass cover 8–20 inches in height year-round. A mosaic of grass heights from 8 to 20 inches with horizontal grass canopy >50% is most similar to habitat selection patterns of Mearns' quail (Bristow and Ockenfels 2000, 2002, 2004). This component may occur in areas naturally protected from grazing (e.g., by topography), or could be provided for by set-asides within grazed areas or refuges established adjacent to grazed areas. Distance to and frequency of this cover type will influence habitat suitability for this species. Since daily movements are relatively small, this component should occur at regular intervals throughout grazed habitats. Patch size should be large enough to prevent concentrating quail, making them more vulnerable to predators.

Mearns' quail are vulnerable at night roosts and nests, given both occur on the ground. Nests are constructed with care and are located within tall bunch grasses (Wallmo 1954). Stromberg (1990) described night roost locations as areas with tall grass associated with a guard object (e.g., a rock). Roost site fidelity has been documented for this species.

Species richness is a measure of habitat quality and rangeland health. Bristow and Ockenfels (2000, 2002, 2004) found Mearns' quail used areas with higher grass, forb, and tree species diversity than random sites.

Woodland Component

Nowhere are Mearns' quail commonly found in areas devoid of overstory tree cover. Woodlands used most heavily throughout this species range are typically comprised of oaks, or a combination of oaks and pines. Overstory trees provide security and thermal cover, and microclimate conducive to forb production (Bristow and Ockenfels 2000). Rarely are Mearns' quail located more than a few dozen yards from trees (Brown 1989), but have been documented far from trees (K. Bristow personal communication). Stromberg (1990) reported Mearns' quail are most often found within 20 yards of oak trees, although his sample was small and the study was short in duration. Brown (1982) recommended that overstory canopy cover be maintained at no less than 20%, and that 30% was optimum. Bristow and Ockenfels (2000) reported Mearns' quail selected for overstory canopy of 26–75%, with optimal levels occurring between 26 – 50%.

Food Component

Habitat selection by Mearns' quail is not only dependent on available cover, but also on the distribution of food plants (Leopold and McCabe 1957, Bishop 1964). Studies of Mearns' quail diet have determined that the bulbs and tubers of Yellow nutsedge (*Cyperus esculentes*) and Gray' woodsorrel (*Oxalis grayi*) account for the majority of their diet (Bishop and Hungerford 1964, Brown 1982). Both these plants show above-ground growth in summer, but may be invisible in fall and spring. Oak woodland provides the microclimates conducive to the production of these and other forbs. Insects and acorns are used in summer and bulbs and tubers are most often used in fall and winter (Bishop and Hungerford 1965; Table 1). As with other gallinaceous birds the diet of young (6–8 weeks) Mearns' quail likely consists primarily of insects.

Moderate grazing, where grass cover requirements are met, is consistent with good Mearns' quail habitat, although Mearns' quail tend to select the more lightly used patches of a pasture (Bristow and Ockenfels 2000). Brown (1982) found higher densities of quail food items in grazed areas than in ungrazed areas. It seems reasonable that the foods used by quail grow best where grass competition is reduced, leading some to suggest that grazing directly benefits Mearns' quail. Leopold and McCabe (1957) documented less food availability in areas of very intense livestock grazing. Regardless of livestock impacts on Mearns' quail food abundance, all studies conducted on Mearns' quail habitat stress that diverse, tall grass is a critical component. When grazing over large areas reduces grass cover below that required by Mearns' quail, they cannot use the available food because of the lack of cover (Brown 1982).

MONITORING

Habitat

To assess habitat components for this species, a minimum of 25 random sample points should be established per pasture (<4 mi²). All measurements should be conducted immediately prior to the start of the annual growing season for grass species (May or June). We recommend measurements be taken at this time since this represents the cumulative use of herbaceous vegetation during a "biological year."

Populations

Effective techniques for monitoring Mearns' quail abundance are lacking (Stromberg 2000). Acoustical surveys, commonly used to survey many birds, are unsuccessful for documenting the presence or relative abundance of Mearns' quail. Brown (1976) tried a number of methods to census Mearns' quail including capture-recapture, call counts, taped call-back, digging counts, and flush counts of coveys located with pointing dogs. Only flush counts with pointing dogs were deemed accurate enough to use for census. However, this technique is very labor and time intensive. It relies on skilled, consistent observers with good dogs. Bristow and Ockenfels (2000) estimated that using a consistent team (human and dog), 9 routes (1–1.5 hrs each) in an area ~75 mi² would be sufficient to develop a population index for this species. Since multiple areas would be required for any meaningful survey, the time and effort required are substantial. In the past, AGFD conducted pre-hunt and post-hunt surveys with volunteer observers and dogs. However, AGFD abandoned these surveys in 2002 due to variability between observers (and dog

abilities) and poor accuracy. Due to the defense strategy and cryptic coloration of Mearns' quail, foot surveys without dogs are considered ineffective.

HABITAT GUIDELINES

1. Horizontal Herbaceous Cover – Manage grazed lands in Mearns' quail habitat to maintain > 50% horizontal canopy cover of grasses.
2. Vertical Herbaceous Cover (Visual Obstruction) – Manage grazed lands in Mearns' quail habitat to provide >50% canopy cover of grass heights from 8 – 20 inches for escape, nesting, brood rearing, and roosting cover.
3. Species Richness – Manage grazed lands in Mearns' quail habitat to maintain or improve species richness. Bristow and Ockenfels (2000) recommended maintaining or restoring 5 or more native perennial bunch grass species in Mearns' habitats. Native forb and tree species diversity should be maintained or enhanced.
4. Tree Canopy – To maintain necessary security-thermal cover and microclimate for the forbs Mearns' quail feed on, manage fire and fuelwood programs to maintain a minimum of 25% tree canopy cover in Mearns' quail habitat. Areas with tree canopy of up to 75% are frequented by Mearns' quail.

Literature Cited

- Bishop, R. A. 1964. The Mearns' Quail (*Cyrtonyx montezumae mearnsi*) in southern Arizona. M. S. Thesis, University of Arizona, Tucson.
- Bishop, R. A., and C. R. Hungerford. 1965. Seasonal food selection of Arizona Mearns' quail. *Journal of Wildlife Management* 29:813–819.
- Bristow, K. D., and R. A. Ockenfels. 2000. Effects of human activity and habitat conditions on Mearns' quail populations. Arizona Game and Fish Department Technical Guidance Bulletin 4. Phoenix, Arizona.
- Bristow K. D., and R. A. Ockenfels. 2002. Brood season habitat selection by Montezuma quail in southeastern Arizona. *Proceedings of the National Quail Symposium* 5:111–116.
- Bristow, K. D., and R. A. Ockenfels. 2004. Pairing season habitat selection by Montezuma quail in southeastern Arizona. *Journal of Range Management* 57:532–538.
- Brown, D. E. 1979. Factors influencing the reproductive success and population densities in Montezuma quail. *Journal of Wildlife Management* 43:522–526.
- Brown, D. E. 1989. Mearns' (Montezuma) Quail. Pp 105–121 *In: Arizona Game Birds*. University of Arizona Press and Arizona Game and Fish Department, Tucson.

- Brown, R. L. 1976. Mearns' Quail census technique. Arizona Game and Fish Department, Federal Aid in Wildlife Restoration Project W-78-R-22, Phoenix, Arizona.
- Brown, R. L. 1978. An ecological study of Mearns' quail. Arizona Game and Fish Department. Federal Aid in Wildlife Restoration final report, Project W-78-R-22 Final report, Phoenix, Arizona.
- Brown R. L. 1979. Mearns' quail census method. Arizona Game and Fish Department Federal Aid to Wildlife Restoration Project W-78-R-15 Final report, Phoenix, Arizona.
- Brown, R. L. 1982. Effects of livestock grazing on Mearns' quail in southeastern Arizona. *Journal of Range Management* 35: 727-732.
- Heffelfinger, J. R., and R. J. Olding. 2000. Montezuma quail management in Arizona. *Proceeding of the National Quail Symposium* 4:183-190.
- Leopold, A. S., and R. A. McCabe. 1957. Natural history of the Montezuma quail in Mexico. *Condor* 59:3-26.
- Stromberg, M. R. 1990. Habitat, movements and roost characteristics of Montezuma Quail in southeastern Arizona. *Condor* 92:229-236.
- Stromberg, M. R. 2000. Montezuma Quail (*Cyrtonyx montezumae*). In *The Birds of North America*, No. 524 (A. Poole and F. Gill, eds.). The birds of North America, Inc., Philadelphia, PA.
- Wallmo, O. C. 1954. Nesting of Mearns' quail in southeastern Arizona. *Condor* 56:125-128.

Table 1. Food items based on 188 crops, 1967-1977:

<i>Cyperus rusbyi</i>	bulb	50.7%
<i>Cyperus rusbyi</i>	seed	0.3%
<i>Cyperus mannimaie</i>	seed	unk, cannot be distinguished from <i>C. rusbyi</i>
<i>Oxalis amplifolia</i>	bulb	25.9%
<i>Paspalum stramineum</i>	seed	7.5%
<i>Galactia wrightii</i>	seed	3.5%
<i>Phaseolus acutifolius</i>	seed	3.1%
<i>Tephrosia tenella</i>	seed	1.8%
<i>Ipomea</i> sp.	seed	1.2%
<i>Arctostaphalos</i> sp.	flowers& fruit	0.8%
<i>Euphorbia dentata</i>	seed	0.6%
<i>Panicum capillare</i>	seed	0.2%
<i>Ambrosia psilostachya</i>	seed	0.1%